INTERDISCIPLINARY CENTRE FOR ADVANCED MATERIALS SIMULATION

ICAMS Special Seminar

Monday, 14th February, 1:00 p.m.
Online Event: see zoom link below

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Chiral superconductivity with enhanced quantized Hall responses in moiré transition metal dichalcogenides

Experimental demonstrations of tunable correlation effects in magic-angle twisted bilayer graphene have put two-dimensional moiré quantum materials at the forefront of condensed-matter research. Other twisted few-layer graphitic structures, boron-nitride, and homo- or hetero-stacks of transition metal dichalcogenides (TMDs) have further enriched the opportunities for analysis and utilization of correlations in these systems. Recently, within the latter material class, strong spin-orbit coupling or excitonic physics were experimentally explored. The observation of a Mott insulating state and other fascinating collective phenomena such as generalized Wigner crystals, stripe phases and quantum anomalous Hall insulators confirmed the relevance of many-body interactions, and demonstrated the importance of their extended range. Interestingly, the interaction, its range, and the filling can be tuned experimentally by twist angle, substrate engineering and gating.

In my talk, I will explain the basics of moiré TMDs and explain how to obtain an accurate effective extended Hubbard model on the triangular superlattice as a starting point for quantum many-body approaches. Then, I will discuss the Fermi surface instabilities and resulting correlated phases of hetero-bilayer TMDs employing a functional renormalization group approach. The results from this approach suggest that hetero-bilayer TMDs are unique platforms to realize topological superconductivity with high winding number which reflects in pronounced experimental signatures such as enhanced quantum Hall features.

https://ruhr-uni-bochum.zoom.us/j/5290130899?pwd=Z0Q4bmlreWN4RktXYXUzTmp1NnBsQT09

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